

**OCEAN  
NETWORKS  
CANADA**

**OCEANS 2.0 API  
PROGRAMMATIC ACCESS TO ONC DATA  
TRAINING SESSION**

Allan Rempel | Feb 8, 2018

**OCEAN  
NETWORKS  
CANADA**

Ocean Networks Canada enhances life on Earth by providing knowledge and leadership that deliver solutions for science, society, and industry.



# OCEAN NETWORKS CANADA

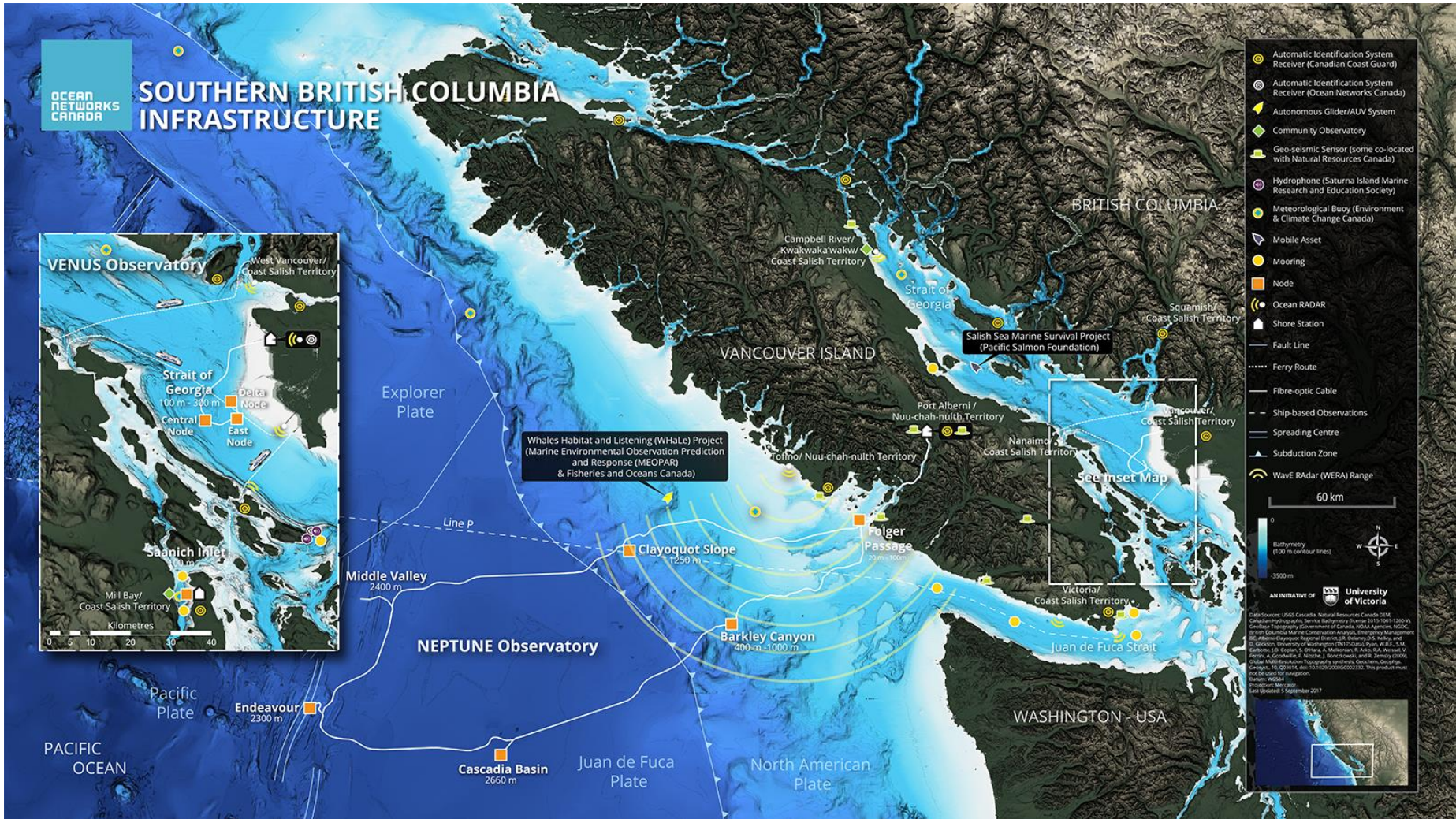
Networks of cabled observatories feeding a data archive





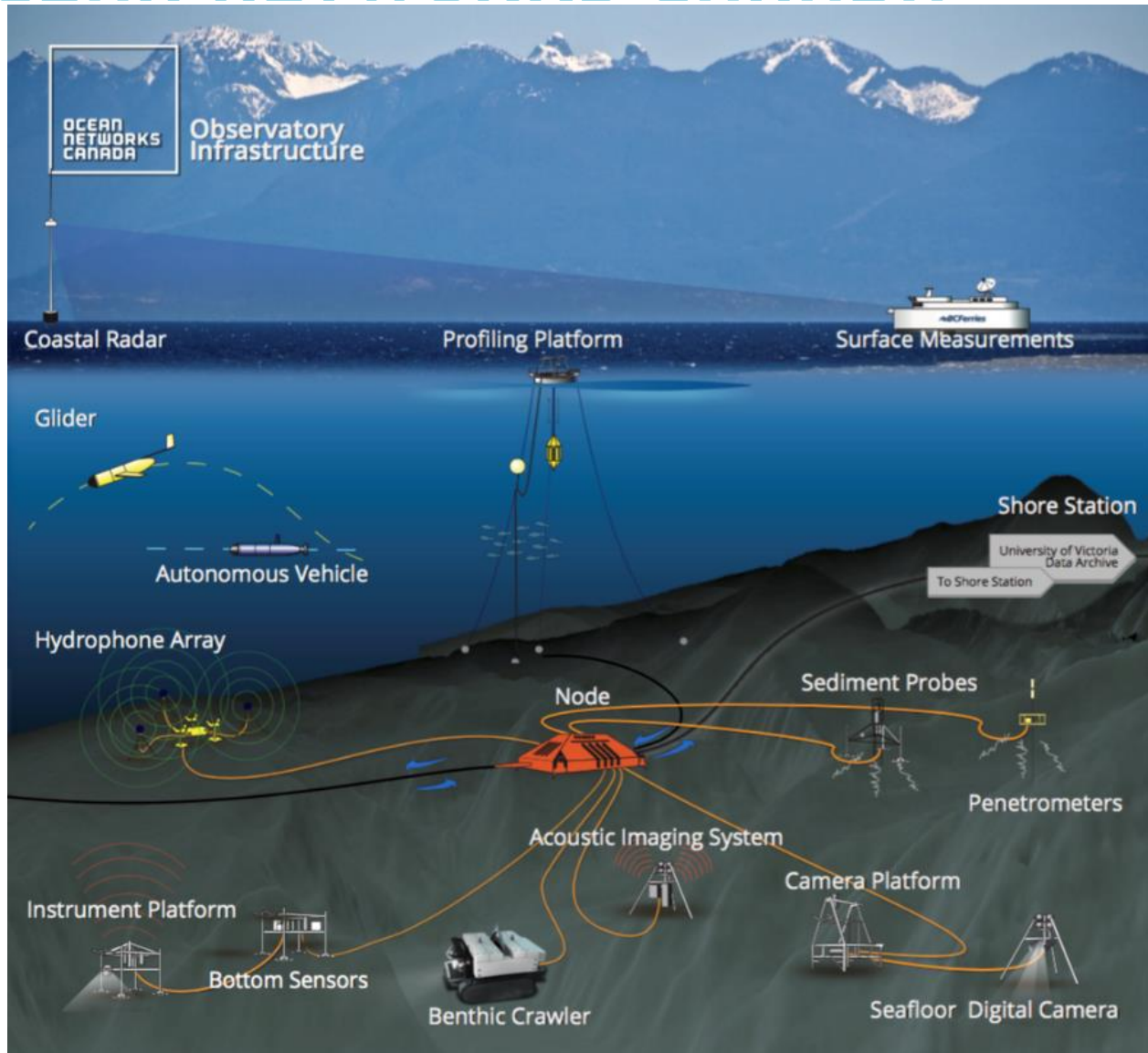
# OCEAN NETWORKS CANADA

Networks of cabled observatories feeding a data archive





# OCEAN NETWORKS CANADA



# OCEAN NETWORKS CANADA

Networks of cabled observatories feeding a data archive

## [Ocean Networks Canada: By the Numbers](#)

- **2** regional and 4 community observatories
- **7** shore stations
- **850+** km seafloor backbone cables
- **over 50** instrumented sites with platform
- **7** mobile instrument platforms
- **400** instruments containing **over 5000** sensors online 24/7/365
- **2006** – the year data began to flow from the VENUS observatory in Saanich Inlet
- **500+** terabytes of data archived in over **26 million** files
- **280** gigabytes of data collected every day
- **35** gigabytes of data are distributed every day
- **\$0.00** – your cost to use the data



# ONC API

## Programmatic access to ONC's Data Archive

The Empower Project

The Web Services

- Discovery
- Data Delivery

The Client Libraries

- Python
- MATLAB
- R \*

The Documentation

- Samples
- Client libraries
- Use Cases

Demos

Testing Plan

Road Ahead

# ONC API

## Empower Project Overview

- A Research Platform for User-Defined Oceanographic Data Products
- 2 Year project funded by CANARIE
- Two Phases

### **API**

Provide researchers with programmatic access to the Oceans 2.0 data products through a specially designed Application Programming Interface (API)

### **Sandbox**

Enable researchers to define, test, use and share processing code for user-defined data products in a custom-designed programming environment.



# ONC API

## API Phase Overview

### User-Centred design approach

- 1) Identify existing and future users
- 2) Develop hypothesis based on domain knowledge and current usage
- 3) Develop questionnaires to validate hypothesis and elicit responses about:
  - a) Research focus
  - b) Data needs
  - c) Analysis needs
  - d) Analytical tools
  - e) Usage and performance expectations
  - f) Publishing needs
- 4) Perform interviews and capture responses
- 5) Analyze responses and organize into functional groups or clusters of requirements
- 6) Develop personas to characterize user goals and behaviours
- 7) Develop use cases to capture the functional needs and requirements of the personas
- 8) Develop user stories to inform the functional design
- 9) Build the API in an iterative cycle of sprints with user feedback and testing throughout

# ONC API

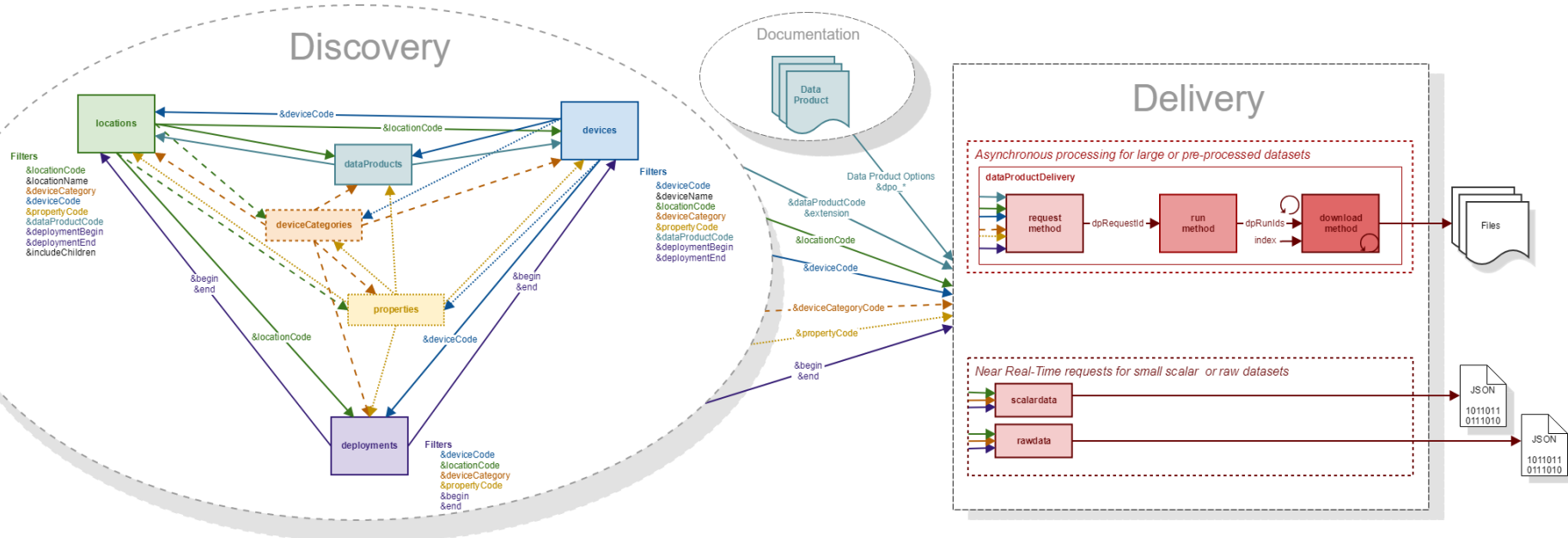
## API Phase Overview

### Results

- 12 user interviews and questionnaires
- 14 existing and future users
- [4 Use Cases](#)
  - Bird Studies Canada
  - Ouranos
  - Academic
  - ONC Internal
- 3 new personas
  - Lead Researcher
  - Scientific Modeller
  - Scientific Developer
- 54 User Stories
- 4 functional groups
  - Discovery
  - Filtering
  - Scripting
  - Internal Needs

# ONC API

## Understanding the web services



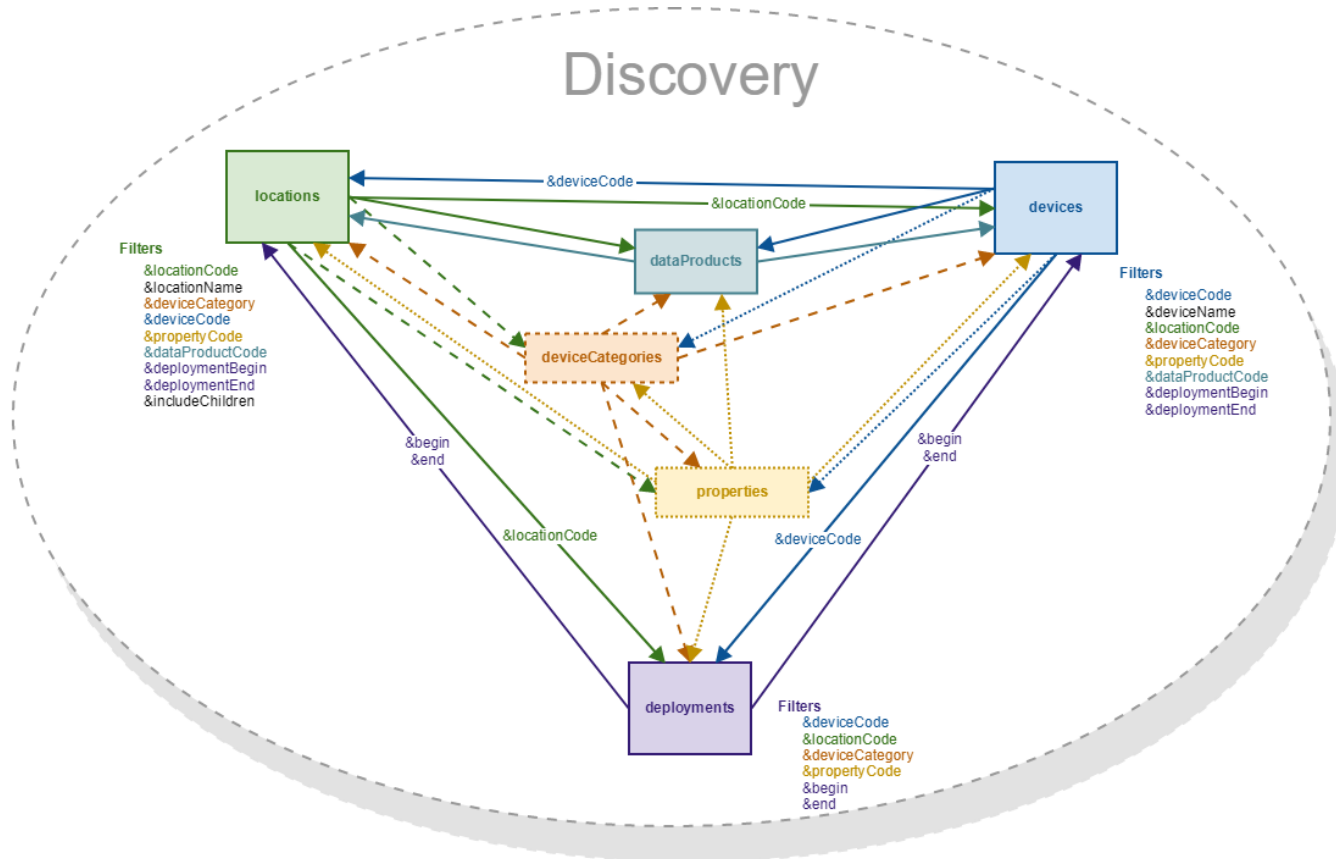
- Data Discovery
  - 6 web services to help discover what data can be downloaded
    - [Where is data available](#)
    - [What devices are available](#)
    - [What device categories are available](#)
    - [What properties are available](#)
    - [What data products are available](#)
    - [When are devices deployed](#)

- Data Delivery (Download)
  - [1 web service to download data as customizable data product](#)
    - Request a Data Product be created
    - Download the Data Product once complete
  - 2 web services for near real-time data access
    - [Scalar data](#)
    - [Raw data](#)



# ONC API

## Data Discovery Services



- 6 Services to Discover the codes needed for the Delivery services
- Common filtering and output allows for discovery of missing/unknown information

# ONC API

## Data Discovery Services

### 6 Service Endpoints

#### [.../api/locations](#)

- ONC search tree nodes (aka, stations) that data can be downloaded from
- Uniquely identified by locationCode.  
e.g. BACME (*Barkley Canyon / MidEast*)

#### [.../api/devices](#)

- Instruments that have one or more sensors that observe a property or phenomenon with a goal of producing an estimate of the value of a property
- Uniquely identified by deviceCode  
e.g. CAM-TEMPO-MINI-2 (*Tempo-Mini Colour Video AXIS Q1755 [Camera 2]*)

#### [.../api/deviceCategories](#)

- Device Category grouping
- Uniquely identified by deviceCategoryCode  
e.g. VIDEOCAM (*Video Camera*)  
DSC (*Still Camera*)

#### [.../api/properties](#)

- Observable phenomenon (aka, variables)
- Common name given to sensor types (e.g. oxygen, pressure, temperature, etc.)
- Uniquely identified by propertyCode

#### [.../api/dataProducts](#)

- Data Products available for download
- Uniquely identified by dataProductCode & extension  
e.g. 3DCIS (*3D Camera Image Stitching*) & tar  
MP4V (*MP4 Video*) & mp4

#### [.../api/deployments](#)

- Instrument deployments
- Uniquely identified by deviceCode & dates
- Each deployment has a location code, device code, lat/long/depth, heading/pitch/roll, has-data flag, and deployment date range.

# ONC API

## Data Discovery Services

- Reductive Filtering
  - Additional filters can be added to the url to reduce the selection

Example - return all locations that have a Video Camera deployed between two dates

```
http://data.oceannetworks.ca/api/locations?method=get
&token=x6ecb030-1835-1dc5-29nc-q58l7wjpl607
&deviceCategory=VIDEOCAM
&deploymentBegin=2016-07-27T00:00:00.000Z
&deploymentEnd=2016-08-01T23:59:59.999Z
```

- Returned as a JSON payload

```
[{"dataProductCode":"AD",
  "dataProductName":"Audio Data",
  "extension":"wav",
  "helpDocument":"https://wiki.oceannetworks.ca/display/DP/7"}]
```



# ONC API

## Data Product Delivery

- Three step process using dataProductDelivery web service

1. Request a data product using the **request** method

- Include data product filters in URL
  - locationCode and deviceCategoryCode *or* locationCode, deviceCategoryCode and propertyCode *or* deviceCode *or* deviceCode and propertyCode
  - dataProductCode and extension
  - begin and end
  - Data Product Options vary with data product
- Returns a RequestId
- Returns run time and size estimates
  - Can be used for request verification

```
https://data.oceannetworks.ca/api/dataProductDelivery?method=request&locationCode=BACAX&deviceCategoryCode=ADCP2MHZ&dataProductCode=LF&extension=txt&begin=2016-07-25T00:00:00.000Z&end=2016-07-29T00:00:00.000Z&token=YOUR\_TOKEN\_HERE
```

```
{"compressedFileSize":25142845,"downloadTimes":{"10Mbps":13.343616,"50Mbps":2.668723,"150Mbps":0.8895744},"dpRequestId":"2615408","fileSize":133436160,"numFiles":4}
```

2. Run the data product using the **run** method

- Include RequestId in URL
- Starts the data product generation process by adding it to the Task Queue

```
https://data.oceannetworks.ca/api/dataProductDelivery?method=run&dpRequestId=2615408&token=YOUR\_TOKEN\_HERE
```

```
[ { "dpRunId": 5991552, "fileCount": 0, "status": "data product running" } ]
```

3. Download the data product using the **download** method

- Include RunId and index in URL
- Informs on process status with messages in the payload HTTP status codes
- Downloads file when process is complete
- Requires same token as run request

```
https://data.oceannetworks.ca/api/dataProductDelivery?method=download&dpRunId=5991552&token=YOUR\_TOKEN\_HERE
```

```
*** no output, you just get the file(s)! ***
```

# ONC API

## Using the web services

- Via browser
  - Make a simple http request using a browser link to return information
- Via code
  - Any language that supports HTTP requests including:
    - Python \*
    - MatLab \*
    - R \*
    - JavaScript
    - C++
    - Java
  - \*Available ONC client libraries
- All requests require a user token
  - Create user at <https://data.oceannetworks.ca/login>
  - Generate token on 'Web Services API' at <http://data.oceannetworks.ca/Profile>
  - Please use your own token
    - It allows us to better understand your data needs and inform you when changes or improvements are made to ONC web services

# ONC API

## Client Libraries

Client libraries provide

- Quick, easy and consistent access to ONC data and resources
- In scientific programming language of choice
- With minimal lines of code

Currently available

-  python 2.7+
- Matlab  R2017a
-  3.3+

<https://wiki.oceannetworks.ca/display/O2A/Client+Libraries>



# ONC API

## Using the Client Libraries

- Python

- Install package using pip
- Add to library to script using

```
from onc.onc import ONC
```
- Create ONC object using

```
onc = ONC("YOUR_TOKEN")  
or  
onc = ONC("YOUR_TOKEN", True, False, "c:/ONC/Data")
```

- MATLAB

- Download Add-On Toolbox from ONC Wiki and install
- Create ONC object using

```
o = ONC("YOUR_TOKEN")  
or  
o = ONC("YOUR_TOKEN", true, false, "c:/ONC/Data")
```

- R

- Download package from ONC Wiki and install
- Add library to script using

```
library(onc)
```
- Create ONC object using

```
onc = new("onc", token="YOUR_TOKEN")  
or  
onc = new("onc", token="YOUR_TOKEN", production=TRUE, showInfo=FALSE, outPath="c:/ONC/Data")
```

# ONC API

## Client Libraries – Single line of code

Download Time Series Scalar Data Product in CSV format for ADCP 2 MHZ at Barkley Canyon - Axis

- Python

```
results = onc.orderDataProduct({'locationCode': 'BACAX',  
                                'deviceCategoryCode': 'ADCP2MHZ',  
                                'dataProductCode': 'TSSD',  
                                'extension': 'csv',  
                                'begin': '2016-07-27T00:00:00.000Z',  
                                'end': '2016-08-01T00:00:00.000Z',  
                                'dpo_qualityControl': 1, 'dpo_resample': 'none', 'dpo_dataGaps': 0})
```

- MATLAB

```
results = o.orderDataProduct(struct('locationCode', 'BACAX', ...  
                                    'deviceCategoryCode', 'ADCP2MHZ', ...  
                                    'dataProductCode', 'TSSD', ...  
                                    'extension', 'csv', ...  
                                    'begin', '2016-07-27T00:00:00.000Z', ...  
                                    'end', '2016-08-01T00:00:00.000Z', ...  
                                    'dpo_qualityControl', 1, 'dpo_resample', 'none', 'dpo_dataGaps', 0));
```

- R

```
results = onc.orderDataProduct(onc, list(locationCode="BACAX",  
                                         deviceCategoryCode="ADCP2MHZ",  
                                         dataProductCode="TSSD",  
                                         extension="csv",  
                                         begin="2016-07-27T00:00:00.000Z",  
                                         end="2016-08-01T00:00:00.000Z",  
                                         dpo_qualityControl=1, dpo_resample="none", dpo_dataGaps=0))
```

# ONC API

## Documentation

- [Guide](#)
  - Overview of the API
  - Requesting Data Products using the API
- [API Reference](#)
- [Sample Code](#)
- [Client Libraries](#)
- Use Cases – [Research](#) and [Internal](#)
- [Oceans 2.0 Knowledge Base](#)
  - [Data Products and Metadata](#)
    - [Data Products Catalog](#)
  - [FAQ](#)

<https://wiki.oceannetworks.ca/display/O2A/Oceans+2.0+API+Home>

**ONC API**

Demo



# ONC API

Your mission, should you choose to accept it...

- Obtain images captured on June 20, 2016 on a Sony SuperScorpio camera on an ROV Expedition.
- What kinds of files can you obtain from a hydrophone in Barkley Sound?
- What is a deviceCategoryCode “CTD” and what properties does it have?
- How many deployments of a deviceCategoryCode “ADCP2MHZ” have there been, and where are they located?

# ONC API

## After this session...

- Please continue to try other data access calls.
- For fun, you can also try out our non-API: [data.oceannetworks.ca](https://data.oceannetworks.ca)
- Please email me with your written feedback and any issues you run across.
  - [agrempel@uvic.ca](mailto:agrempel@uvic.ca)
- We'll meet back here in 2 weeks – Thursday Feb. 22, 10am
- Your feedback will guide further development both by me and the ONC Software team.

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## THANK YOU!

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 @ocean\_networks  OceanNetworksCanada visit: [oceannetworks.ca](http://oceannetworks.ca)